Homework 1 – Due Wednesday, January 23, 2007 <u>before</u> the lecture

Please refer to the general information handout for the full homework policy and options.

Page limit   You can submit **at most** 1 page per problem, even if the problem has multiple parts. If you submit a longer solution for some problem, only the first page will be graded. This homework contains 3 mandatory and 1 optional problem, worth 10 points each.

Reminder   Collaboration is permitted, but you must write the solutions *by yourself without assistance*, and be ready to explain them orally to the instructor if asked. You must also identify your collaborators. Getting solutions from outside sources such as the Web or students not enrolled in the class is strictly forbidden.

Exercises   Please practice on solved exercises and problems in Chapters 0 and 1. The material they cover may appear on exams.

Problems

   0. (Bonus, 5pts) Post a recognizable phone of your face on Angel.

   1. (**Proof techniques review**)

      (a) (**Horses**) Book, 0.11.
      (b) (**Collaborators**) There are 18 students enrolled in the Theory of Computation course. At the end of the semester, the grader reported for each pair of students whether they have ever collaborated with each other on the homework. Prove that there exist 2 students that collaborated with exactly the same number of other students.

   2. (**DFA and NFA constructions**) In all parts the alphabet is $\{0, 1\}$. Give state diagrams of DFAs recognizing the the following languages.

      (a) $L_1 = \{w \mid w$ represents a binary number equivalent to (0 mod 5) or (3 mode 5)$\}$. Leading 0s should be ignored.
      (b) $L_2 = \{w \mid w$ contains an odd number of 0s and an even number of 1s$\}$.

      Give state diagrams of NFAs recognizing the the following languages.

      (c) $L_3 = \emptyset^*$.
      (d) $L_4 = \{w \mid w$ does not contain 10$\}$.

      Pick one of L_1, L_2, L_4, clearly specify your choice and

      (e) give a regular expression for this language.

   3. (**Reverse and sum**) Book, 1.31,1.32.

   4. 4* (**Optional, no collaboration is allowed, please hand in your solution on a separate sheet of paper**) Book, 1.57.